

## Today's Learning Goal(s):

Date: \_\_\_\_\_

By the end of the class, I will be able to:

- a) determine the equation of the inverse of a quadratic function.

$$\begin{matrix} a & 11c \\ b & 3bd \\ c & 4e, 5a, 7c \end{matrix}$$

Last day's Assigned Practice:

pp. 153-154 #3, 4ace, 5ac, 7ac, 8, 11

3. Determine the maximum or minimum value for each.

a)  $y = -4(x + 1)^2 + 6$   
 b)  $f(x) = (x - 5)^2 + 0$

↳ min. value of 0

c)  $f(x) = -2x(x - 4)$   
 d)  $g(x) = 2x^2 - 7$

$$= 2(x-0)^2 - 7$$

↳ min value of -7

4. Determine the maximum or minimum value. Use at least two different K methods.

a)  $y = x^2 - 4x - 1$   
 b)  $f(x) = x^2 - 8x + 12$   
 c)  $y = 2x^2 + 12x$

$$\begin{aligned} y &= x^2 - 4x + 4 - 4 - 1 \\ &= (x-2)^2 - 5 \\ \therefore \text{min. value} &= -5 \end{aligned}$$

d)  $y = -3x^2 - 12x + 15$   
 e)  $y = 3x(x - 2) + 5$   
 f)  $g(x) = -2(x + 1)^2 - 5$

$$\begin{aligned} &\text{if } 3x(x-2)=0 \\ &x=0, x=2 \\ &\therefore \text{Afs: } x = \frac{0+2}{2} \\ &x=1 \\ &\therefore f(1) = 3(1)(1-2)+5 \\ &= 3(-1)+5 \\ &= -3+5 \\ &= 2 \end{aligned}$$

∴ min value is 2.

p. 153

5. Each function is the demand function of some item, where  $x$  is the number of items sold, in thousands. Determine

- i) the revenue function  
 ii) the maximum revenue in thousands of dollars

a)  $p(x) = -x + 5$

b)  $p(x) = -4x + 12$

c)  $p(x) = -0.6x + 15$

d)  $p(x) = -1.2x + 4.8$

$$\begin{aligned} R(x) &= [p(x)]x \\ &= (-x+5)x \\ &= -x^2 + 5x \end{aligned}$$

$$\begin{aligned} \text{A of } S: x &= \frac{-b}{2a} \\ &= \frac{-5}{2(-1)} \\ &= \frac{5}{2} \\ &= 2.5 \end{aligned}$$

$$\begin{aligned} R(2.5) &= (-x+5)(x) \\ &= (-2.5+5)(2.5) \\ &= (2.5)(2.5) \\ &= 6.25 \end{aligned}$$

but in thousands  
 \$6250

$$\begin{aligned} R(x) &= (-0.6x+15)(x) \\ &= -0.6x^2 + 15x \\ &= -0.6(x^2 - 25x + 12.5^2 - 12.5^2) \\ &= -0.6(x-12.5)^2 + 93.75 \\ \therefore \text{The max. revenue is } &\$93750 \end{aligned}$$

p. 154 7. For each pair of revenue and cost functions, determine

- i) the profit function
- ii) the value of  $x$  that maximizes profit

- a)  $R(x) = -x^2 + 24x, C(x) = 12x + 28$
- b)  $R(x) = -2x^2 + 32x, C(x) = 14x + 45$
- c)  $R(x) = -3x^2 + 26x, C(x) = 8x + 18$
- d)  $R(x) = -2x^2 + 25x, C(x) = 3x + 17$

$$\begin{aligned}
 i) P(x) &= R(x) - C(x) \\
 &= -3x^2 + 26x - (8x + 18) \\
 &= -3x^2 + 26x - 8x - 18 \\
 &= -3x^2 + 18x - 18
 \end{aligned}$$

$$\begin{aligned}
 x &= \frac{-b}{2a} \\
 &= \frac{-18}{2(-3)} \\
 &= 3
 \end{aligned}$$

$\therefore$  a value of  $x = 3$  max. profits

- p. 154 11. The profit  $P(x)$  of a cosmetics company, in thousands of dollars, is given by
- A**  $P(x) = -5x^2 + 400x - 2550$ , where  $x$  is the amount spent on advertising, in thousands of dollars.
- Determine the maximum profit the company can make.
  - Determine the amount spent on advertising that will result in the maximum profit.
  - What amount must be spent on advertising to obtain a profit of at least \$4 000 000?

$$\begin{aligned}
 P(x) &= -5x^2 + 400x - 2550 \\
 &= -5(x^2 - 80x) - 2550 \\
 &= -5(x^2 - 80x + 1600 - 1600) - 2550 \\
 &= -5(x-40)^2 - 5(-1600) - 2550 \\
 &= -5(x-40)^2 + 8000 - 2550 \\
 &= -5(x-40)^2 + 5450
 \end{aligned}$$

$\therefore 40$  (x 1000)  
 $= 40 000$  should be  
 spent on advertising.

$$\text{Profit} = 4 000 000$$

$$P(x) = 4 000$$

$$\begin{aligned}
 4000 &= -5x^2 + 400x - 2550 \\
 0 &= -5x^2 + 400x - 2550 - 4000 \\
 0 &= -5x^2 + 400x - 6550 \\
 0 &= -5(x^2 - 80x - 1310)
 \end{aligned}$$

$$\begin{aligned}
 x &= \frac{-(-80) \pm \sqrt{(-80)^2 - 4(1)(-1310)}}{2(1)} \\
 &= \frac{80 \pm \sqrt{1640}}{2}
 \end{aligned}$$

$$\begin{aligned}
 x &\doteq -13.9 \quad \text{or} \quad x \doteq 93.944415 \\
 &\text{inadmissible} \quad \doteq 93.944.415 \\
 &\doteq 93.944.42
 \end{aligned}$$

$\therefore \$93.944.42$  should be spent  
 on advertising for a profit  
 of \$4 000 000.

## Today's Learning Goal(s):

By the end of the class, I will be able to:

- a) determine the equation of the inverse of a quadratic function.

### 3.3 The Inverse of a Quadratic Function

Date: Oct. 4/19

Recall: The inverse of a function undoes a function.

To find the equation, switch the  $x$  and  $y$  variables and rearrange for  $y$ .

For a function with coordinates  $(x, y)$ , the inverse will have coordinates  $(y, x)$ .

Ex. 1:

- a) Graph  $f(x) = 2(x - 2)^2 - 4$  and its inverse.  $(2, -4) \rightarrow (-4, 2)$
- b) Is the inverse a function?

*No; it fails the V.L.T.*

- c) Determine the equation of the inverse.

$$y = 2(x - 2)^2 - 4$$

$$x = 2(y - 2)^2 - 4$$

$$x + 4 = 2(y - 2)^2$$

$$\frac{x+4}{2} = (y-2)^2$$

$$\pm\sqrt{\frac{x+4}{2}} = y - 2$$

$$y = \pm\sqrt{\frac{x+4}{2}} + 2$$

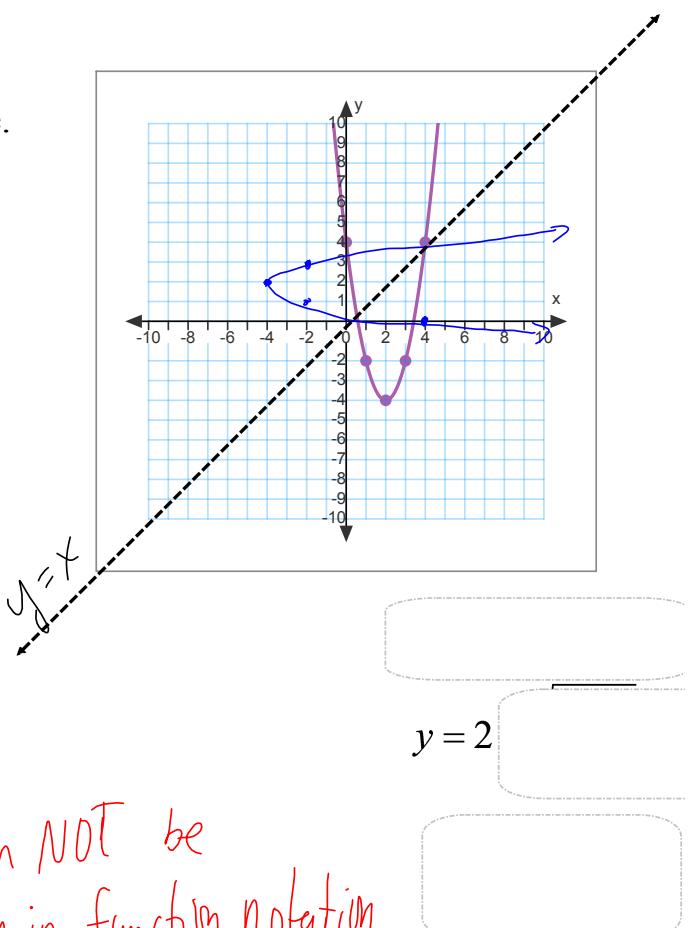
or  
 $y = \pm\sqrt{\frac{1}{2}(x+4)} + 2$  ← can NOT be written in function notation.

- d) Determine the Domain and Range of  $f(x)$  and the inverse.

$$D_f: \{x \in \mathbb{R}\}$$

$$D_{\text{inverse}}: \{x \in \mathbb{R} | x \geq -4\}$$

$$R_f: \{y \in \mathbb{R} | y \geq -4\} \quad R_{\text{inverse}}: \{y \in \mathbb{R}\}$$



Are there any questions from last day's assigned work you would like to see on the board?

Last day's Assigned Practice: pp. 153-154 #3, 4ace, 5ac, 7ac, 8, 11

Today's Assigned Practice includes:

pp. 160-162 #1 – 5, 7, 9, 13 [17]

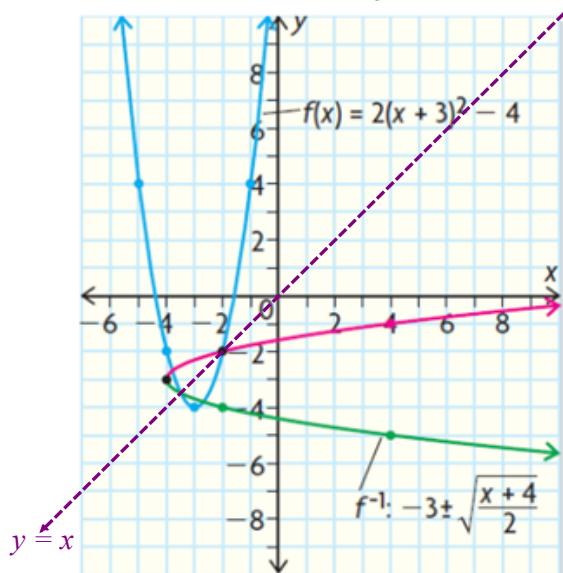
*An additional example follows...*

p.157 Ex.2

## 3.3 The Inverse of a Quadratic Function

Recall: The inverse of a function undoes a function. To find the equation, switch the x- and y-variables and rearrange for y. For a function with coordinates  $(x, y)$ , the inverse will have coordinates  $(y, x)$ .

Eg. 1) Given the quadratic function  $f(x) = 2(x + 3)^2 - 4$ , graph  $f(x)$  and its inverse. Also determine the equation of the inverse.



$$\begin{aligned}
 f(x) &= 2(x + 3)^2 - 4 \\
 y &= 2(x + 3)^2 - 4 \\
 x &= 2(y + 3)^2 - 4 \\
 x + 4 &= 2(y + 3)^2 \\
 \frac{x + 4}{2} &= (y + 3)^2 \\
 \pm \sqrt{\frac{x + 4}{2}} &= y + 3 \\
 -3 \pm \sqrt{\frac{x + 4}{2}} &= y
 \end{aligned}$$